AD-A166 552 PRESSURE TEST OF THREE ELLIPTIC MISSILE BODY CONFIGURATIONS(U) ARNOLD ENGINEERING DEVELOPMENT CENTER ARNOLD AFS TN M E SELLERS OCT 85 AEDC-TSR-85-P19 1/1

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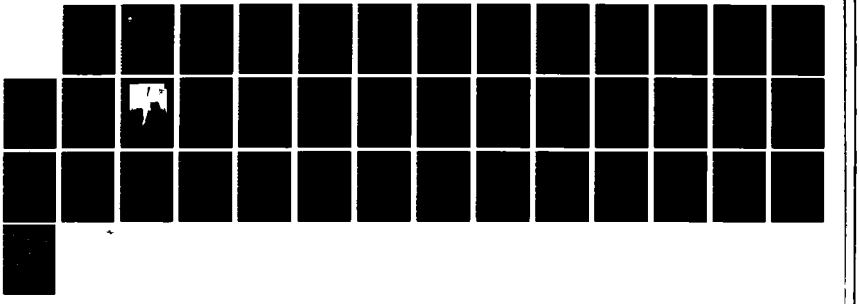

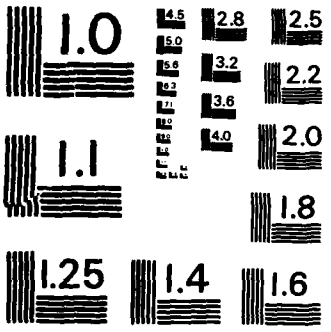

AEDC-TSR-85-P19

(2)

PRESSURE TEST OF THREE ELLIPTIC MISSILE BODY CONFIGURATIONS

Marvin E. Sellers
Calspan Corporation/AEDC Division

October 1985

Final Report for Period 15 September 1985 - 17 September 1985

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This report has been reviewed and approved.

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A wind tunnel test was conducted to obtain the surface pressure distributions of three elliptic missile body configurations. The test was performed at nominal Mach numbers from 0.4 to 1.3 at a constant nominal free-stream unit Reynolds number of 2.4 million per ft. The angle-of-attack range was -4 to 20 deg at sideslip angles of -4, 0, and 4 deg. Only sample tabulations of the test results are included in the report.

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II. TITLE

Pressure Test of Three Elliptic Missile Body Configurations

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APPENDIXES

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III. Sample Tabulated Data

Sample

NOMENCLATURE

ALPHA	Angle of attack, deg
ALPI	Indicated pitch angle, deg
a	Semimajor (horizontal) span at X, in.
a_{max}	Semimajor span at model base, in. (See Table 1)
BETA	Sideslip angle, deg
b	Semiminor (vertical) height at X, in.
b_{max}	Semiminor height at model base, in. (See Table 1)
CONFIG	Model configuration designation
CPBW	Bottom wall pipe pressure coefficient, (PBW-P)/Q
CPBWA	Average bottom wall pipe pressure coefficient, $(CPBW_i + CPBW_{i+30})/2$, i = 1 to 30
CPTW	Top wall pipe pressure coefficient, (PTW-P)/Q
CPTWA	Average top wall pipe pressure coefficient, $(CPTW_i + CPTW_{i+30})/2$, i = 1 to 30
CPW	Model surface pressure coefficient, (PW-P)/Q
L	Model length, 36.000 in.
M	Free-stream Mach number
MU	Dynamic viscosity based on free-stream temperature, lbf-sec/ft^2
ORIF NO	Pipe pressure orifice identification number
P	Free-stream static pressure, psfa
PBA	Average base pressure, (PBT + PBB + PBL + PBR)/4, psfa
PBi	Base pressure, i = T, B, L, and R, where T, B, L, and R are top, bottom, left, and right looking upstream, respectively, psfa
PBW	Bottom wall pipe pressure, psfa
PHII	Indicated roll angle, deg
PT	Tunnel stilling chamber pressure, psfa

PTW	Top wall pipe pressure, psfa
PW	Model surface pressure, psfa
Q	Free-stream dynamic pressure, psf
RE	Free-stream unit Reynolds number, ft^{-1}
RHO	Free-stream density, lbm/ft^3
RUN	Data set identification number
T	Free-stream static temperature, °R
TAP NO	Model pressure orifice identification number
THETA	Instrumentation radial location on model surface measured from top centerline ray, positive clockwise looking upstream, deg
TS	Tunnel station, in.
TT	Tunnel stilling chamber temperature, °F
TW_i	Model wall temperature, i = T and B, where T and B are top and bottom, respectively, °F
V	Free-stream velocity, ft/sec
X	Axial location from nose of model, in.

1.0 INTRODUCTION

The work reported herein was conducted by the Arnold Engineering Development Center (AEDC), Air Force Systems Command (AFSC), under Program Element 62201F, Control Number 2404, at the request of Air Force Wright Aeronautical Laboratories (AFWAL/FIMG), Wright-Patterson Air Force Base, Ohio. The AFWAL/FIMG project manager was Mr. Don Shereda. The results were obtained by Calspan Corporation, AEDC Division, operating contractor for the Aerospace Flight Dynamics testing effort at the AEDC, AFSC, Arnold Air Force Station, Tennessee. The test was conducted in the Aerodynamic Wind Tunnel (4T) of the Propulsion Wind Tunnel (PWT) Facility during the period from September 15-17, 1985, under AEDC Project Number CD48PB, PWT Test Number TC-793.

The purpose of the test was to obtain the surface pressure distributions, with emphasis on the leeside pressure distribution, of three elliptic missile body configurations with ellipticity ratios of 2.0, 2.5, and 3.0 to 1.0. Data were also obtained on two static pressure pipes mounted near the tunnel top and bottom walls for one configuration at Mach numbers up to and including 1.05. The pipe pressure data were used to determine if there were any significant wall interference effects on the model surface pressure distribution. The test was performed at nominal Mach numbers from 0.4 to 1.3 at a constant nominal free-stream unit Reynolds number of 2.4 million per foot. The angle-of-attack range was -4 to 20 deg at sideslip angles of -4, 0, and 4 deg.

The purpose of this report is to document the test and to describe the test parameters. The report provides information to permit use of the data but does not include any data analysis, which is beyond the scope of this report.

The final data package from the test has been transmitted to AFWAL/FIMG. Request for these data should be addressed to AFWAL/FIMG, Wright-Patterson AFB, Ohio 45433. A copy of the final tabulated data package is on file on microfilm at the AEDC.

2.0 APPARATUS

2.1 Test Facility

The AEDC Aerodynamic Wind Tunnel (4T) is a closed-loop continuous flow, variable-density tunnel in which the Mach number can be varied from 0.1 to 1.3 and can be set at discrete Mach numbers of 1.6 and 2.0 by placing nozzle inserts over the permanent sonic nozzle. At all Mach numbers, the stagnation pressure can be varied from 300 to 3,400 psfa. The test section is 4-ft square and 12.5-ft long with perforated, variable porosity (0.5- to 10-percent open) walls. It is completely enclosed in a plenum chamber from which air can be evacuated, allowing part of the tunnel airflow to be removed through the perforated walls of the test section. The model support system consists of a sector and sting attachment which has a pitch

angle capability of -8 to 27 deg with respect to the tunnel centerline and a roll capability of ± 180 deg about the sting centerline. A more complete description of the tunnel may be found in Ref. 1.

2.2 Test Articles

The installation of the test articles and static pressure pipes in Tunnel 4T is shown in Figure 1. The test articles were elliptic missile body configurations with ellipticity ratios of 2.0, 2.5, and 3.0 to 1.0. The models were power-law bodies with an exponent of 0.5 and had the same longitudinal distribution of cross-sectional area. The semi-major and semi-minor axis ordinates were derived from the following equations:

For horizontal projection (semi-major axis)

$$a = \frac{a_{max}}{L^{0.5}} \cdot X^{0.5}$$

and for vertical projection (semi-minor axis)

$$b = \frac{b_{max}}{L^{0.5}} \cdot X^{0.5}$$

Details of the models are given in Figure 2 and the model configuration designation is presented in Table 1.

Each model was instrumented with 191 0.045-in.-diam surface pressure orifices and four base pressure orifices. The location and designation of the pressure orifices are presented in Figure 3 and were identical for all three models. Table 2 provides nominal axial locations from the nosetip and nominal radial locations from the top ray (positive clockwise looking upstream) of the pressure orifices. Two thermocouples were attached to the inner wall of each model and the general location is given in Table 2.

The static pressure pipes were mounted on the centerline of the top and bottom walls. Details of the pressure pipes are shown in Figure 4. Each pipe had 30 pressure orifices on each of the model and wall sides of the pipes. The relationship between the model and pipe pressure orifice locations is shown in Figure 5, and the nominal location of the pressure orifices on the pipe is provided in Table 3.

2.3 Test Instrumentation

The model surface and base pressures and the pipe pressures were measured with 15-psid electronically-scanned pressure (ESP) modules referenced to atmosphere. The pressure modules included five 48-port modules located in the model and two 48-port and two 16-port modules located outside the test section and connected to the pipes. Every port in each module had a silicon pressure transducer that was digitally addressed and calibrated online. The relatively small size of each pressure module (1.15 x 1.45 x 2.7 in.) permitted the onboard mounting which resulted in a significant reduction in the delay time for pressure stabilization. The data quality of the ESP modules was monitored by applying and measuring a known pressure on the first and last port on each module. Model wall temperatures were measured with two copper-constantan thermocouples attached to the inner wall of each model.

3.0 TEST DESCRIPTION

3.1 Test Conditions and Procedures

Model surface and base pressures were obtained at Mach numbers from 0.4 to 1.3. The pipe pressure data were obtained for one configuration at Mach numbers from 0.4 to 1.05. The nominal test conditions established during the test are given in Table 4. Tunnel conditions were held constant while varying model attitude. Data were recorded at selected angles using the pitch/roll pause technique. Data were obtained at angles of attack from -4 to 20 deg at sideslip angles of -4, 0, and 4 deg. A test run number summary is presented in Table 5.

3.2 Data Acquisition and Reduction

All steady-state measurements were sequentially recorded by the facility on-line computer system and reduced to the desired final form. The data were then tabulated in the Tunnel 4T control room, recorded on magnetic tape, and transmitted to the AEDC central computer file. The data stored in the central computer file were generally available for plotting and analysis on the PWT Interactive Graphics System within 30 seconds after data acquisition. The immediate availability of the tabulated data permitted continual on-line monitoring of the test results. A typical data plot generated on the PWT Interactive Graphics System is shown in Figure 6.

Surface and base pressure data were normalized by the free-stream static pressure and the surface and pipe pressure data were

reduced to pressure coefficient form. Selected surface pressure data were also presented graphically by constructing three-dimensional color contour plots over the model shape.

3.3 Uncertainty of Measurements

Uncertainties (combinations of system and random errors) of the basic tunnel parameters, shown in Figure 7, were estimated from repeat calibrations of the instrumentation and from the repeatability and uniformity of the test section flow during tunnel calibration. Uncertainties in the instrumentation systems were estimated from repeat calibration of the systems against secondary standards whose uncertainties are traceable to the National Bureau of Standards calibration equipment. The tunnel parameter and instrument uncertainties, for a 95-percent confidence level, were combined using the Taylor series method of error propagation described in Ref. 1 to determine the uncertainties of the parameters in Table 6.

4.0 DATA PACKAGE PRESENTATION

The final data package contained, 1) tabulated data summaries listing specific parameters, 2) digital magnetic computer tapes containing summary data, 3) test article installation and color contour plot photographs, 4) test run number summary, 5) model configuration identification, and 6) model sketches. Sample tabulated data are presented in Appendix III.

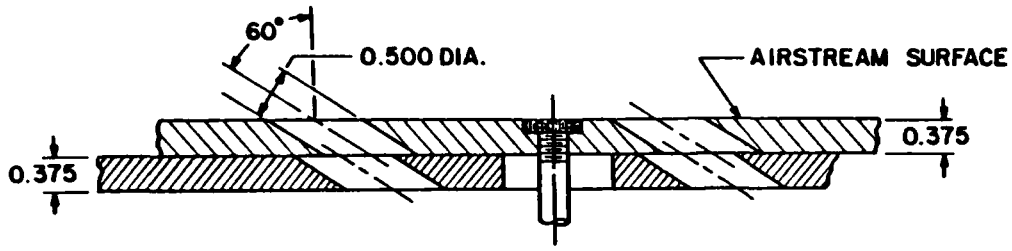
REFERENCES

1. Test Facilities Handbook (Twelfth Edition). "Propulsion Wind Tunnel Facility, Vol. 4." Arnold Engineering Development Center, March 1984.

2. Abernethy, R. B. and Thompson, J. W., Jr. "Handbook - Uncertainty in Gas Turbine Measurements." AEDC-TR-73-5 (AD755356), February 1973.

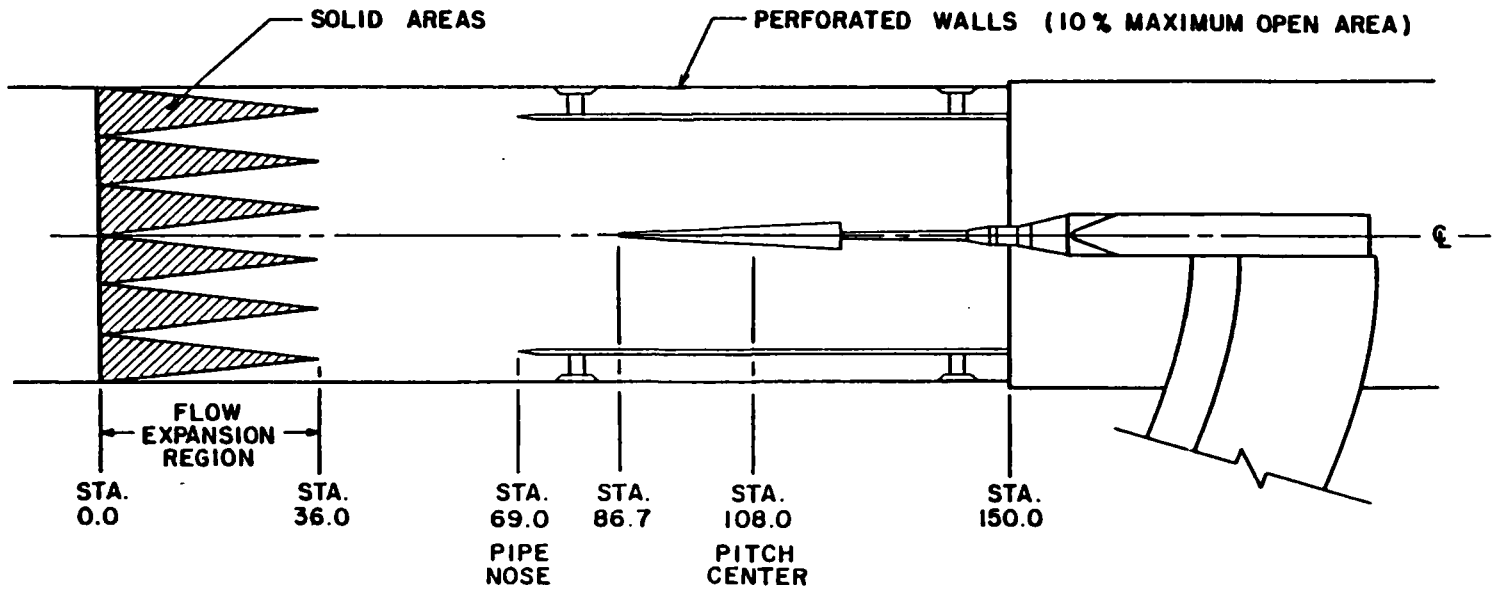
APPENDIX I

Illustrations



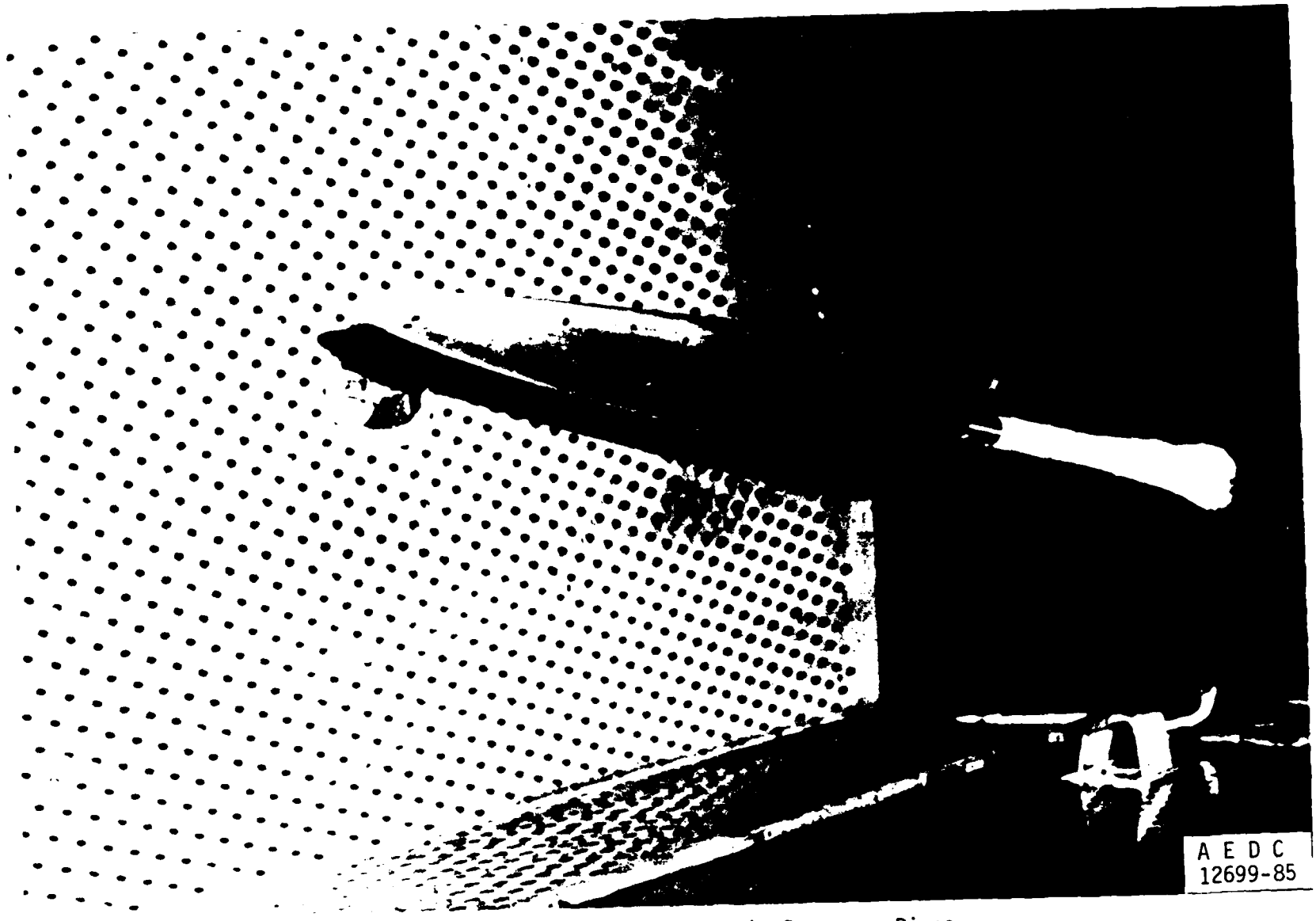
TYPICAL PERFORATED WALL CROSS SECTION

TUNNEL STATIONS AND DIMENSIONS ARE IN INCHES



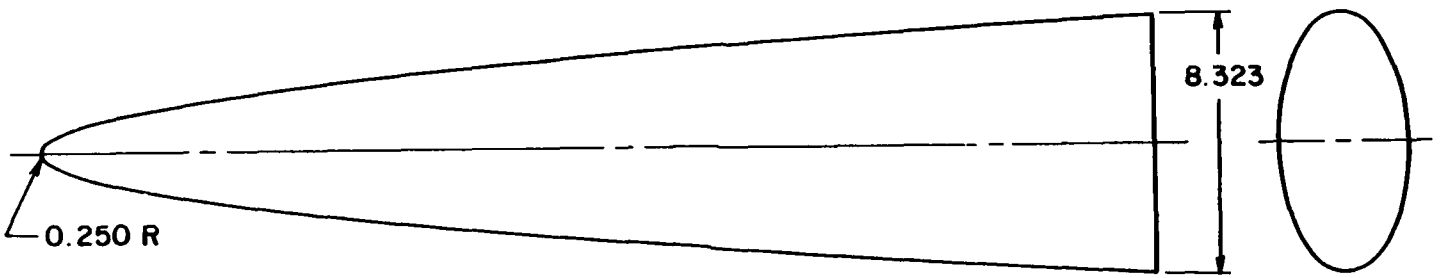
a. Test Article Location in Tunnel 4T

Figure 1. Model Installation

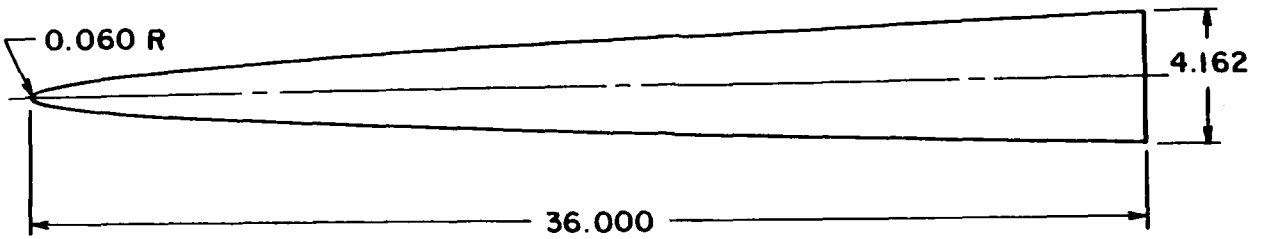


b. Configuration B25 and Static Pressure Pipes

Figure 1. Concluded.



TOP VIEW

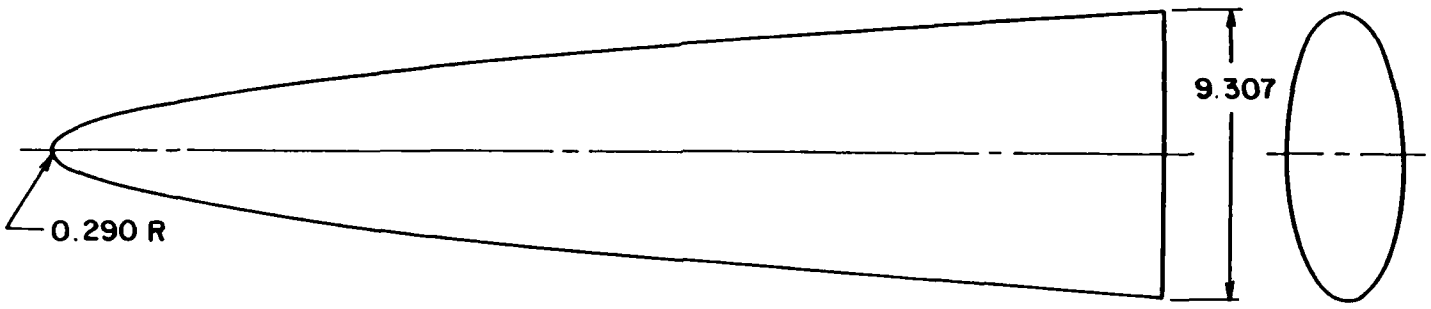


SIDE VIEW

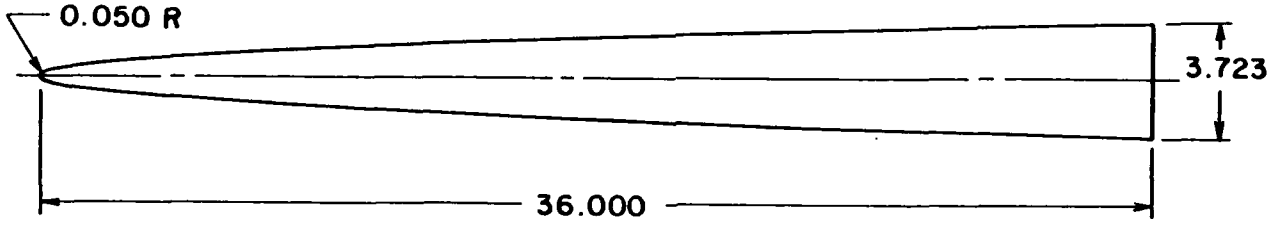
DIMENSIONS IN INCHES

a. B20 Configuration

Figure 2. Model Details



TOP VIEW

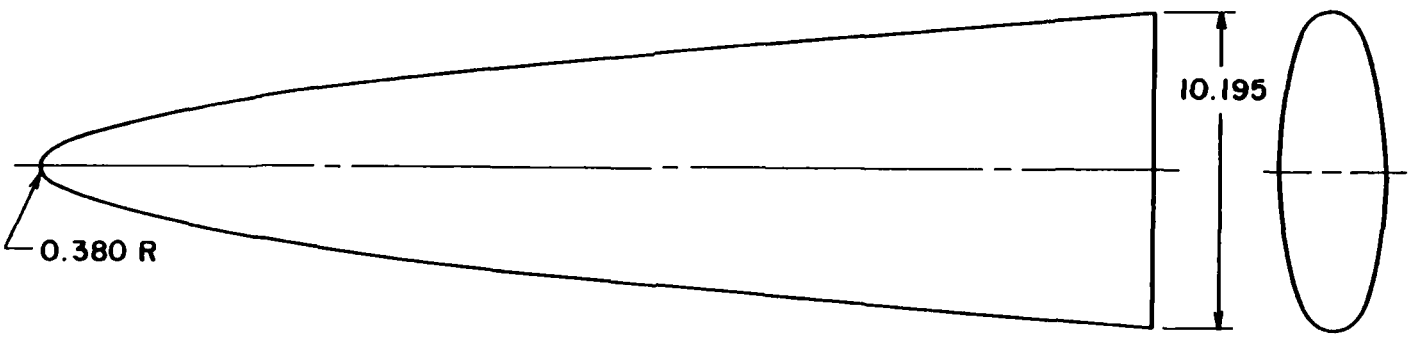


SIDE VIEW

DIMENSIONS IN INCHES

b. B25 Configuration

Figure 2. Continued



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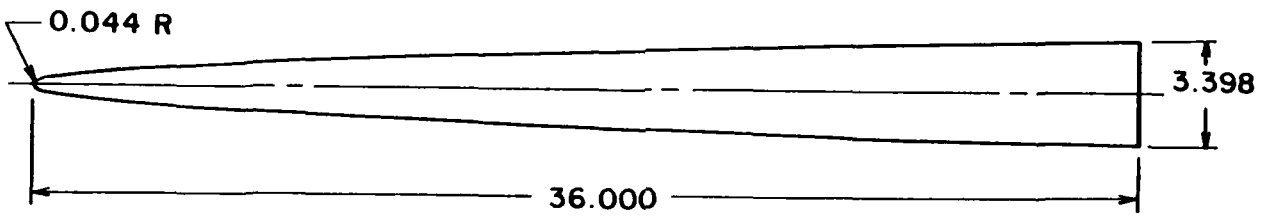
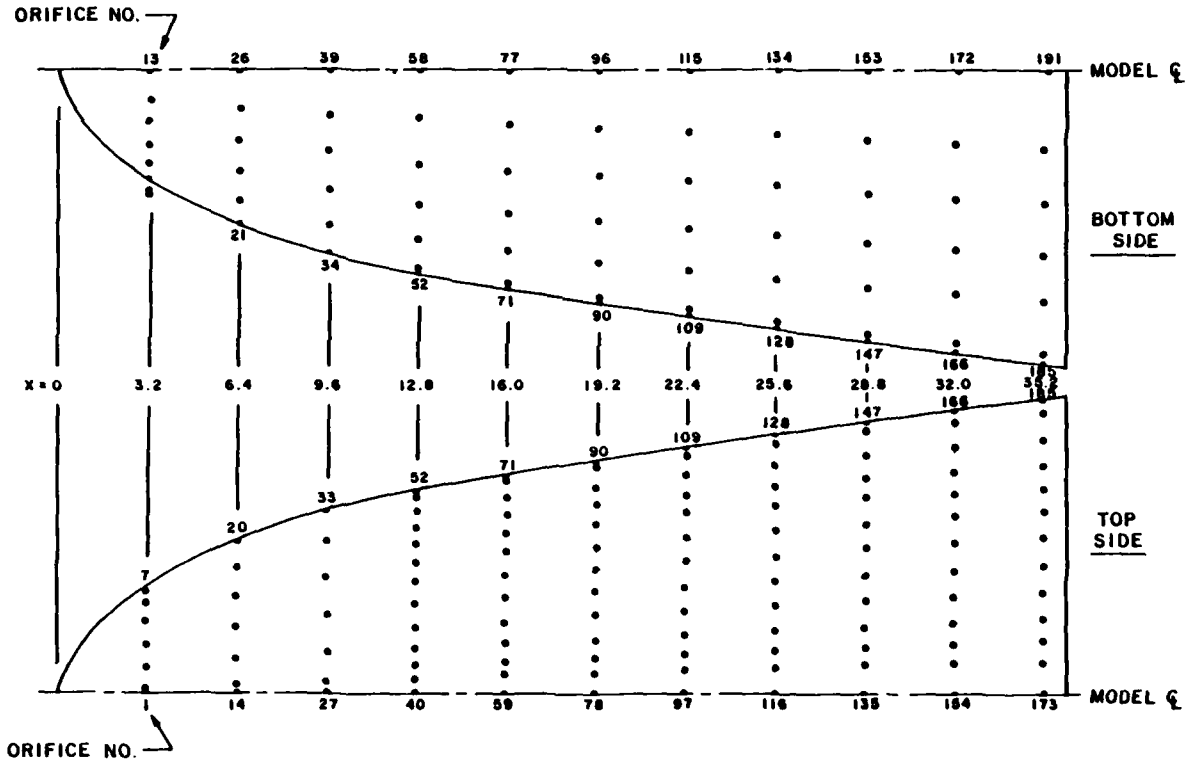


SIDE VIEW

DIMENSIONS IN INCHES

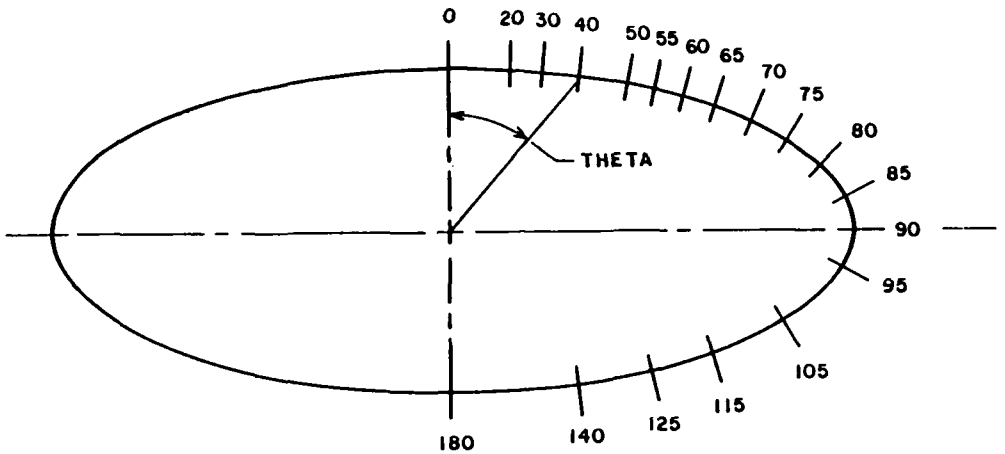
c. B30 Configuration

Figure 2. Concluded

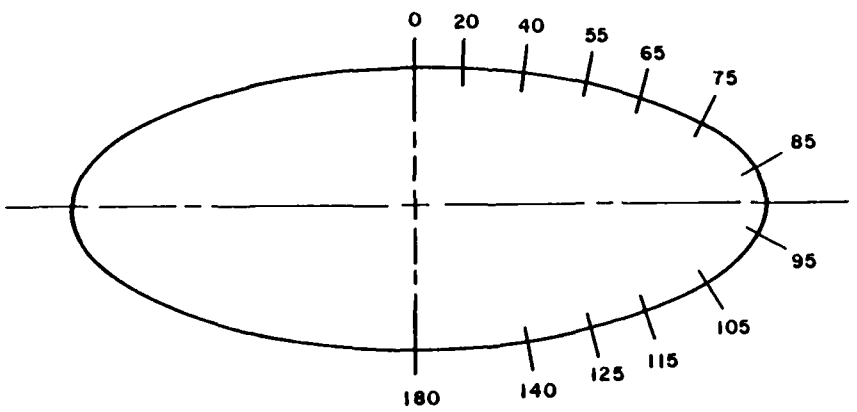


a. Axial Location

Figure 3. Model Pressure Orifice Location and Designation



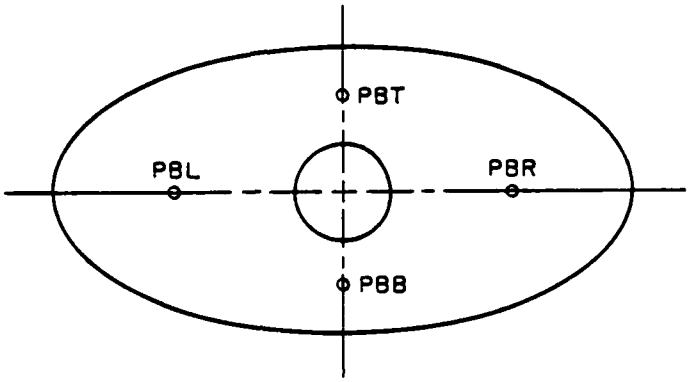
X = 12.8 TO 35.2



X = 3.2 TO 9.6

b. Radial Location

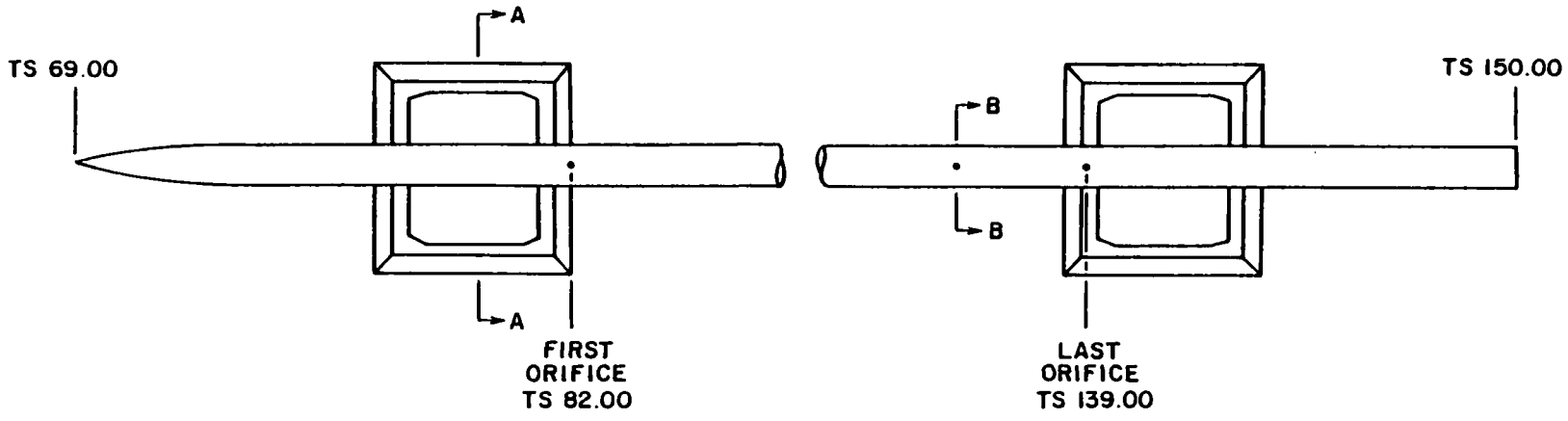
Figure 3. Continued

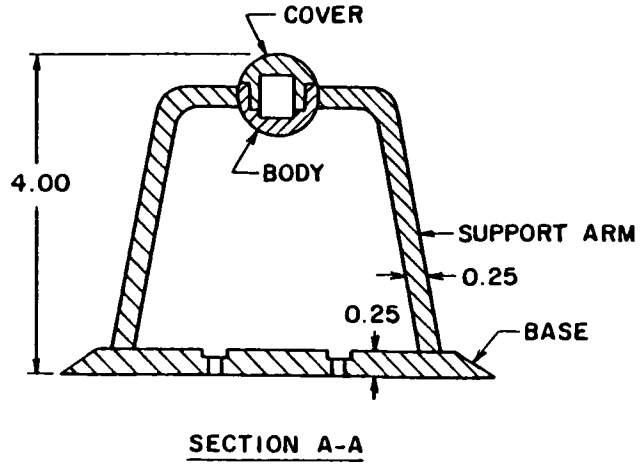


Looking Upstream (PHI = 0)

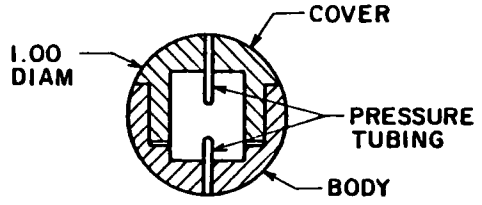
c. Base Pressure Orifice Location

Figure 3. Concluded





SECTION A-A



SECTION B-B

DIMENSIONS IN INCHES

Figure 4. Static Pressure Pipe Details

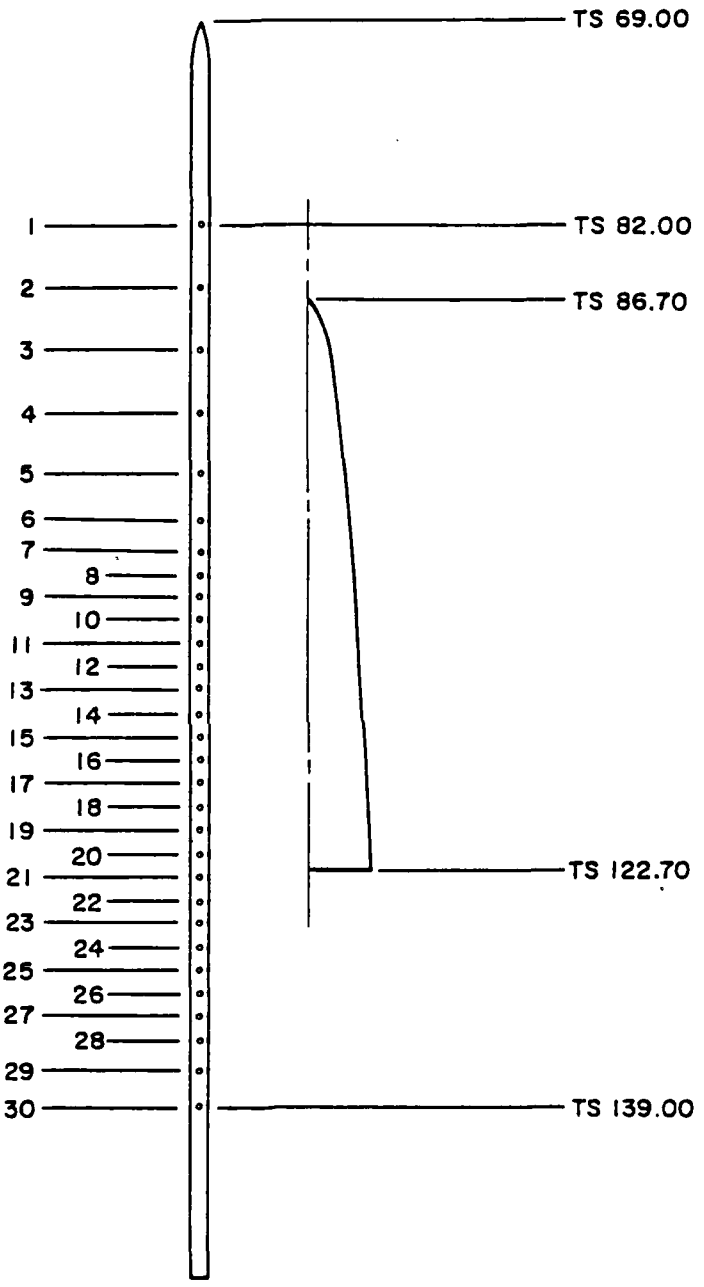


Figure 5. Relationship of Model to the Wall Pipe Pressure Orifices

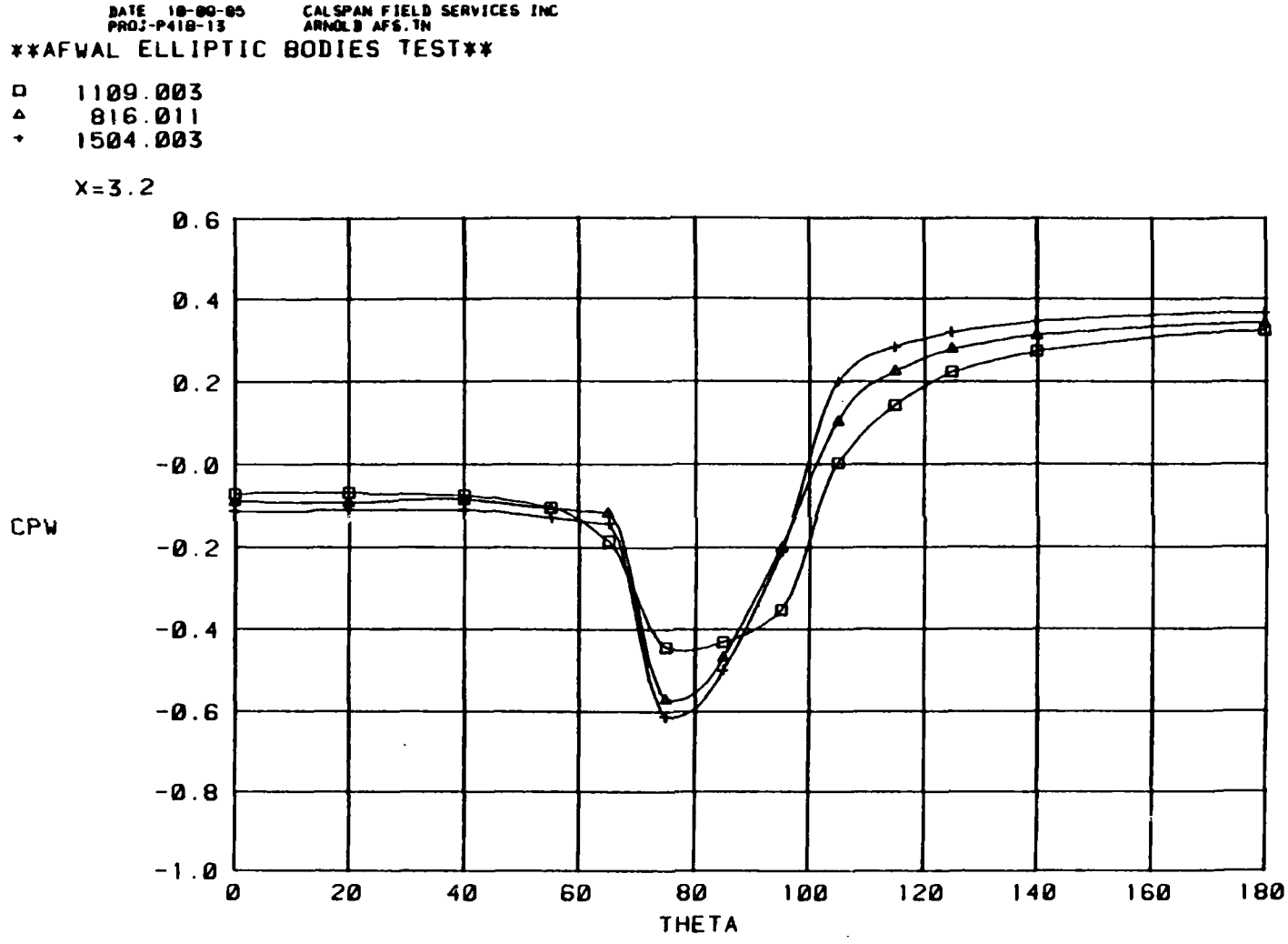


Figure 6. Typical Data Plot

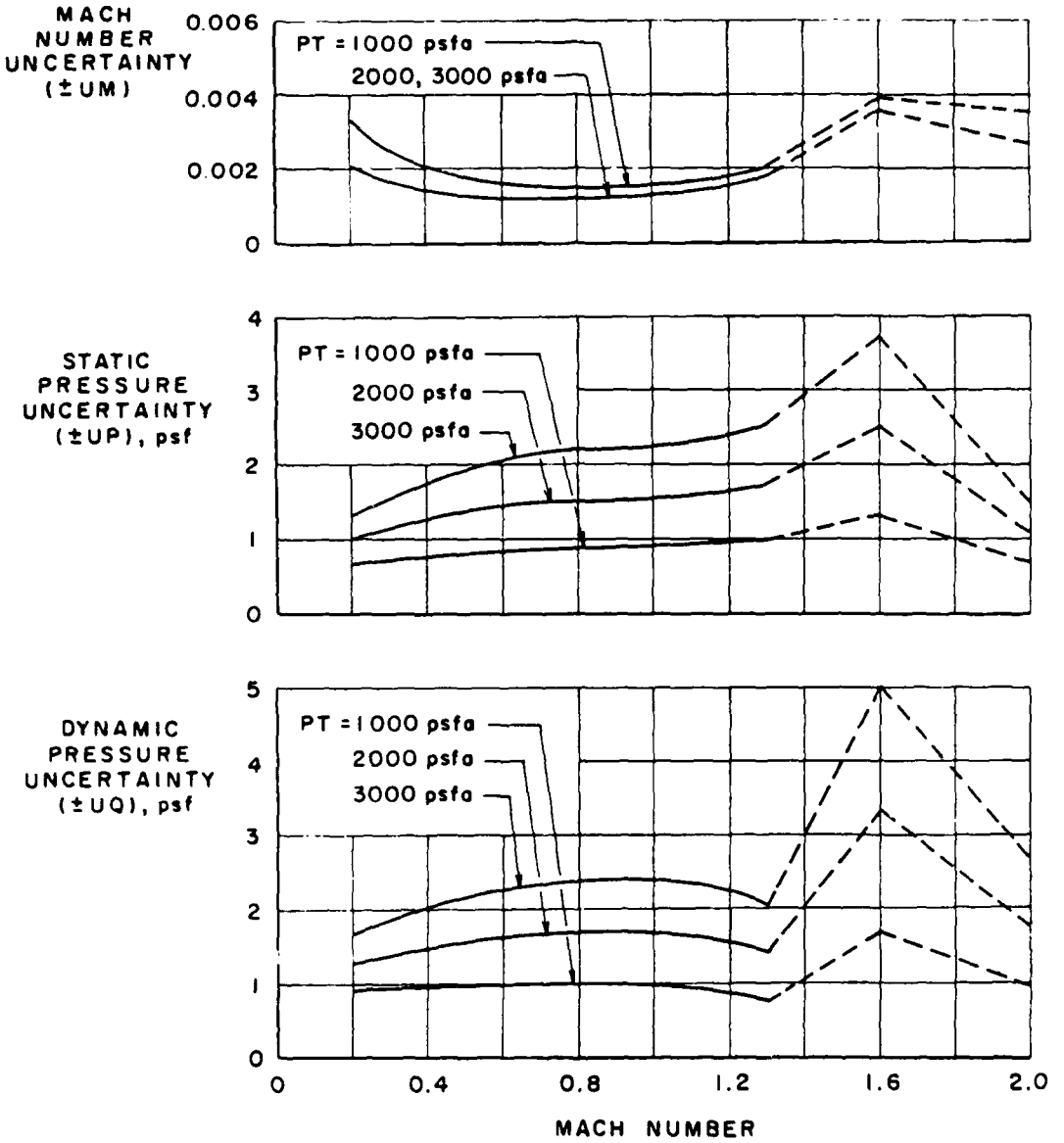


Figure 7. Estimated Uncertainties in 4T Tunnel Parameters

APPENDIX II

Tables

Table 1. Model Configuration Designation

CONFIG	Description
B20	2:1 elliptic body, a_{max} = 4.162 in.
	b_{max} = 2.081 in.
	L = 8.323 in.
B25	2.5:1 elliptic body, a_{max} = 4.654 in.
	b_{max} = 1.862 in.
	L = 9.307 in.
B30	3:1 elliptic body, a_{max} = 5.098 in.
	b_{max} = 1.699 in.
	L = 10.195 in.

Table 2. Pressure Orifice Location and Designation

THETA \ X	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	35.2
0	1	14	27	40	59	78	97	116	135	154	173
20	2	15	28	41	60	79	98	117	136	155	174
30				42	61	80	99	118	137	156	175
40	3	16	29	43	62	81	100	119	138	157	176
50				44	63	82	101	120	139	158	177
55	4	17	30	45	64	83	102	121	140	159	178
60				46	65	84	103	122	141	160	179
65	5	18	31	47	66	85	104	123	142	161	180
70				48	67	86	105	124	143	162	181
75	6	19	32	49	68	87	106	125	144	163	182
80				50	69	88	107	126	145	164	183
85	7	20	33	51	70	89	108	127	146	165	184
90				52	71	90	109	128	147	166	185
95	8	21	34	53	72	91	110	129	148	167	186
105	9	22	35	54	73	92	111	130	149	168	187
115	10	23	36	55	74	93	112	131	150	169	188
125	11	24	37	56	75	94	113	132	151	170	189
140	12	25	38	57	76	95	114	133	152	171	190
180	13	26	39	58	77	96	115	134	153	172	191

NOTE: Thermocouples located at approximately X = 22.4 and THETA = 0 and 180.

Table 3. Static Pressure Pipe Orifice Locations

Orifice Number		Tunnel Station (in.)
Model Side of Pipe	Wall side of Pipe	
1	31	82.0
2	32	86.0
3	33	90.0
4	34	94.0
5	35	98.0
6	36	101.0
7	37	103.0
8	38	104.5
9	39	106.0
10	40	107.5
11	41	109.0
12	42	110.5
13	43	112.0
14	44	113.5
15	45	115.0
16	46	116.5
17	47	118.0
18	48	119.5
19	49	121.0
20	50	122.5
21	51	124.0
22	52	125.5
23	53	127.0
24	54	128.5
25	55	130.0
26	56	131.5
27	57	133.0
28	58	134.5
29	59	136.5
30	60	139.0

Table 4. Nominal Test Conditions

M	PT	P	Q	RE x 10-6
0.4	2090	1872	210	2.30
0.4#	2040	1826	205	2.25
0.55	1625	1324	281	2.32
0.8	1265	829	372	2.37
0.95	1174	659	414	2.36
1.05	1120	560	432	2.31
1.1	1120	524	444	2.30
1.2	1120	462	466	2.30
1.3	1120	405	479	2.30
1.3*	1170	424	500	2.38

For CONFIG B20 only.
* For CONFIG B30 only.

Table 5. Test Run Number Summary

CONFIG	M	BETA	ALPHA														
			-4	-3	-2	-1	0	1	2	3	4	6	8	10	12	16	20
B20	0.4	-4	1242	1243	1244	1245	1246	1247	1248	1249	1250	1251	1252	1253	1254	1255	1256
		0	1258	1259	1260	1261	1262	1263	1264	1265	1266	1267	1268	1269	1270	1271	1272
		4	1274	1275	1276	1277	1278	1279	1280	1281	1282	1283	1284	1285	1286	1287	1288
	0.55	-4	1193	1194	1195	1196	1197	1198	1199	1200	1201	1202	1203	1204	1205	1206	1207
		0	1209	1210	1211	1212	1213	1214	1215	1216	1217	1218	1219	1220	1221	1222	1223
		4	1225	1226	1227	1228	1229	1230	1231	1232	1233	1234	1235	1236	1237	1238	1239
	0.8	-4	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917
		0	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933
		4	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949
	0.95	-4	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965
		0	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981
		4	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997
	1.05	-4	999	1000	1001	1002	1003	1004	1005	1006	1007	1008	1009	1010	1011	1012	1013
		0	1015	1016	1017	1018	1019	1020	1021	1022	1023	1024	1025	1026	1027	1028	1029
		4	1031	1032	1033	1034	1035	1036	1037	1038	1039	1040	1041	1042	1043	1044	1045
	1.1	-4	1047	1048	1049	1050	1051	1052	1053	1054	1055	1056	1057	1058	1059	1060	1061
		0	1063	1064	1065	1066	1067	1068	1069	1070	1071	1072	1073	1074	1075	1076	1077
		4	1079	1080	1081	1082	1083	1084	1085	1086	1087	1088	1089	1090	1091	1092	1093

Table 5. Continued

CONFIG	M	BETA	ALPHA														
			-4	-3	-2	-1	0	1	2	3	4	6	8	10	12	16	20
B20	1.2	-4	1096	1097	1098	1099	1100	1101	1102	1103	1104	1105	1106	1107	1108	1109	1110
		0	1112	1113	1114	1115	1116	1117	1118	1119	1120	1121	1122	1123	1124	1125	1126
		4	1128	1129	1130	1131	1132	1133	1134	1135	1136	1137	1138	1139	1140	1141	1142
	1.3	-4	1144	1145	1146	1147	1148	1149	1150	1151	1152	1153	1154	1155	1156	1157	1158
		0	1160	1161	1162	1163	1164	1165	1166	1167	1168	1169	1170	1171	1172	1173	1174
		-4	1176	1177	1178	1179	1180	1181	1182	1183	1184	1185	1186	1187	1188	1189	1190
B25	0.4	-4*	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570
		0*	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586
		4*	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602
	0.55	-4*	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363
		0*	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379
		4*	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395
	0.8	-4*	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412
		0*	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429
		4*	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445
	0.95	-4*	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461
		0*	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477
		4*	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493

Table 5. Continued

CONFIG	M	BETA	ALPHA														
			-4	-3	-2	-1	0	1	2	3	4	6	8	10	12	16	20
B25	0.95	-4	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669
		0	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688
		4	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704
	1.05	-4*	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515
		0*	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531
		4*	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547
		-4	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720
		0	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736
		4	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752
	1.1	-4	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768
		0	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784
		4	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801
	1.2	-4	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817
		0	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834
		4	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850
	1.3	-4	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866
		0	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882
		4	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898

Table 5. Continued

CONFIG	M	BETA	ALPHA														
			-4	-3	-2	-1	0	1	2	3	4	6	8	10	12	16	20
B30	0.4	-4	1634	1635	1636	1637	1638	1639	1640	1641	1642	1643	1644	1645	1646	1647	1648
		0	1650	1651	1652	1653	1654	1655	1656	1657	1658	1659	1660	1661	1662	1663	1664
		4	1666	1667	1668	1669	1670	1671	1672	1673	1674	1675	1676	1677	1678	1679	1680
	0.55	-4	1586	1587	1588	1589	1590	1591	1592	1593	1594	1595	1596	1597	1598	1599	1600
		0	1602	1603	1604	1605	1606	1607	1608	1609	1610	1611	1612	1613	1614	1615	1616
		4	1618	1619	1620	1621	1622	1623	1624	1625	1626	1627	1628	1629	1630	1631	1632
	0.8	-4	1300	1301	1302	1303	1304	1305	1306	1307	1308	1309	1310	1311	1312	1313	1314
		0	1317	1318	1319	1320	1321	1322	1323	1324	1325	1326	1327	1328	1329	1330	1331
		4	1333	1334	1335	1336	1337	1338	1339	1340	1341	1342	1343	1344	1345	1346	1347
	0.95	-4	1349	1350	1351	1352	1353	1354	1355	1356	1357	1358	1359	1360	1361	1362	1363
		0	1365	1366	1367	1368	1369	1370	1371	1372	1373	1374	1375	1376	1377	1378	1379
		4	1381	1382	1383	1384	1385	1386	1387	1388	1389	1390	1391	1392	1393	1394	1395
	1.05	-4	1397	1398	1399	1400	1401	1402	1403	1404	1405	1406	1407	1408	1409	1410	
		0	1413	1414	1415	1416	1417	1418	1419	1420	1421	1422	1423	1424	1425	1426	1427
		4	1429	1430	1431	1432	1433	1434	1435	1436	1437	1438	1439	1440	1441	1442	
	1.1	-4	1445	1446	1447	1448	1449	1450	1451	1452	1453	1454	1455	1456	1457	1458	
		0	1460	1461	1462	1463	1464	1465	1466	1467	1468	1469	1470	1471	1472	1473	
		4	1476	1477	1478	1479	1480	1481	1482	1483	1484	1485	1486	1487	1488	1489	

Table 5. Concluded

CONFIG	M	BETA	ALPHA														
			-4	-3	-2	-1	0	1	2	3	4	6	8	10	12	16	20
B30	1.2	-4	1491	1492	1493	1494	1495	1496	1497	1498	1499	1500	1501	1502	1503	1504	
		0	1507	1508	1509	1510	1511	1512	1513	1514	1515	1516	1517	1518	1519	1520	
		4	1522	1523	1524	1525	1526	1527	1528	1529	1530	1531	1532	1533	1534	1535	
	1.3	-4	1540	1541	1542	1543	1544	1545	1546	1547	1548	1549	1550	1551	1552	1553	
		0	1555	1556	1557	1558	1559	1560	1561	1562	1563	1564	1565	1566	1567	1568	
		4	1570	1571	1572	1573	1574	1575	1576	1577	1578	1579	1580	1581	1582	1583	

NOTE: Runs 349-602 had the Static Pressure Pipes in the tunnel. These runs are indicated by (*) in the BETA column.

Table 6. Estimated Uncertainties

M	U(PW/P)	U(CPW)
0.4	0.039	0.016
0.55	0.042	0.012
0.8	0.054	0.0086
0.95	0.060	0.0076
1.05	0.064	0.0073
1.1	0.066	0.0071
1.2	0.075	0.0068
1.3	0.087	0.0067

APPENDIX III

Sample Tabulated Data

TEST TC-793 AFWAL ELLIPTIC BODIES PRESSURE TEST PAGE 1

RUN	M	ALPHA	BETA	CONFIG	ALPI	PHII
349	0.55	-4.18	-4.04	825	5.71	-135.01

PT	P	Q	TT	T	RHO	V	MU	REX10-6	TWT	TWB	PBT/P	PBR/P	PBB/P	PBL/P	PBA/P
1625.4	1322.9	280.6	111.0	538.1	4.609E-02	625.9	3.846E-07	2 331	104 0	100.0	0.9610	0.9383	0.9552	0.9492	0.9509

*** MODEL SURFACE PRESSURE RATIO,PW/P ***

TAP NO	1-13	14-26	27-39	40-58	59-77	78-96	97-115	116-134	135-153	154-172	173-191
X	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	35.2
THETA											
0	1.012	1.011	1.009	1.006	1.006	1.005	1.004	1.002	0.999	0.994	0.974
20	1.009	1.008	1.008	1.005	1.005	1.005	1.002	1.001	0.999	0.994	0.975
30				1.003	1.005	1.006	1.001	0.999	0.999	0.993	0.974
40	1.013	1.010	1.005	1.002	1.004	1.005	1.001	1.000	0.999	0.992	0.974
50				1.003	1.003	1.003	1.000	0.999	0.998	0.992	0.973
55	1.009	1.006	1.006	1.003	1.004	1.003	1.000	0.999	0.998	0.990	0.973
60				1.003	1.004	1.001	0.999	0.997	0.998	0.990	0.973
65	1.008	1.007	1.005	1.001	1.003	1.000	0.997	0.997	0.997	0.989	0.972
70				1.001	1.001	1.000	0.995	0.997	0.995	0.988	0.972
75	1.008	1.003	1.000	0.997	0.997	0.998	0.996	0.996	0.994	0.986	0.972
80				0.997	0.996	0.993	0.993	0.992	0.990	0.985	0.972
85	1.002	0.996	0.991	0.992	0.992	9.999	0.987	0.988	0.987	0.981	0.968
90				0.987	0.988	0.989	0.987	0.987	0.985	0.980	0.967
95	0.991	0.990	0.990	0.990	0.990	0.993	0.990	0.990	0.990	0.984	0.972
105	0.988	0.987	0.992	0.995	0.995	0.992	0.991	0.991	0.988	0.985	0.969
115	0.992	0.994	0.996	0.995	0.993	0.993	0.995	0.993	0.992	0.990	0.971
125	0 994	0.994	0.997	0.994	0.996	0.994	0.995	0.994	0.995	0.989	0.972
140	0.995	0.997	0.997	0.997	0.993	0.996	0.996	0.995	0.994	0.987	0.972
180	0.994	0.996	0.997	0.996	0.994	0.995	0.994	0.993	0.992	0.987	0.970

Sample 1. Model Surface Pressure Ratio Data

TEST TC-793 AFWAL ELLIPTIC BODIES PRESSURE TEST PAGE 2

RUN	M	ALPHA	BETA	CONFIG	ALPI	PHII
349	0.55	-4.18	-4.04	B25	5.71	-135.01

PT	P	Q	TT	T	RHO	V	MU	REX10-6	TWT	TWB	PBT/P	PBR/P	PBB/P	PBL/P	PBA/P
1625.4	1322.9	280.6	111.0	538.1	4.609E-02	625.9	3.846E-07	2.331	104.0	100.0	0.9610	0.9383	0.9552	0.9492	0.9509

••• MODEL SURFACE PRESSURE COEFFICIENT,CPW •••

TAP NO	1-13	14-26	27-39	40-58	59-77	78-96	97-115	116-134	135-153	154-172	173-191
X	3.2	6.4	9.6	12.8	16.0	19.2	22.4	25.6	28.8	32.0	35.2
THETA											
0	0.0567	0.0513	0.0407	0.0261	0.0275	0.0256	0.0202	0.0071	-0.0047	-0.0295	-0.1248
20	0.0445	0.0400	0.0371	0.0222	0.0245	0.0227	0.0084	0.0049	-0.0044	-0.0303	-0.1184
30				0.0157	0.0247	0.0267	0.0028	-0.0030	-0.0056	-0.0339	-0.1230
40	0.0595	0.0467	0.0233	0.0097	0.0197	0.0223	0.0027	-0.0007	-0.0027	-0.0376	-0.1228
50				0.0154	0.0122	0.0126	-0.0002	-0.0041	-0.0079	-0.0372	-0.1261
55	0.0442	0.0263	0.0264	0.0135	0.0209	0.0148	0.0012	-0.0067	-0.0111	-0.0465	-0.1254
60				0.0127	0.0168	0.0037	-0.0042	-0.0126	-0.0098	-0.0466	-0.1291
65	0.0392	0.0338	0.0240	0.0027	0.0124	-0.0000	-0.0118	-0.0135	-0.0140	-0.0529	-0.1316
70				0.0049	0.0058	-0.0009	-0.0214	-0.0147	-0.0220	-0.0567	-0.1317
75	0.0362	0.0144	-0.0012	-0.0137	-0.0122	-0.0073	-0.0209	-0.0204	-0.0263	-0.0644	-0.1317
80				-0.0140	-0.0166	-0.0347	-0.0331	-0.0354	-0.0456	-0.0726	-0.1309
85	0.0079	-0.0211	-0.0422	-0.0362	-0.0398	9.9993	-0.0621	-0.0574	-0.0609	-0.0898	-0.1527
90				-0.0627	-0.0547	-0.0529	-0.0612	-0.0622	-0.0692	-0.0948	-0.1535
95	-0.0434	-0.0463	-0.0485	-0.0477	-0.0463	-0.0346	-0.0480	-0.0460	-0.0494	-0.0764	-0.1337
105	-0.0581	-0.0630	-0.0394	-0.0223	-0.0220	-0.0356	-0.0425	-0.0433	-0.0554	-0.0725	-0.1462
115	-0.0368	-0.0297	-0.0165	-0.0249	-0.0307	-0.0336	-0.0240	-0.0316	-0.0356	-0.0477	-0.1364
125	-0.0274	-0.0274	-0.0165	-0.0270	-0.0203	-0.0277	-0.0241	-0.0286	-0.0222	-0.0524	-0.1337
140	-0.0221	-0.0164	-0.0135	-0.0138	-0.0312	-0.0167	-0.0208	-0.0240	-0.0300	-0.0636	-0.1311
180	-0.0286	-0.0172	-0.0133	-0.0178	-0.0278	-0.0241	-0.0280	-0.0323	-0.0390	-0.0599	-0.1429

Sample 2. Model Surface Pressure Coefficient Data

RUN	M	ALPHA	BETA	CONFIG	ALPI	PHII
349	0.55	-4.18	-4.04	825	5.71	-135.01

PI	P	Q	TT	T	RHO	V	MU	REX10-6	TWT	TWB	PBT/P	PBR/P	PBB/P	PBL/P	PBA/P
1625.4	1322.9	290.6	111.0	538.1	4.609E-02	625.9	3.846E-07	2.331	104.0	100.0	0.9610	0.9383	0.9552	0.9492	0.9509

*** TUNNEL NEAR WALL PRESSURES ***

TOP WALL						BOTTOM WALL							
ORIF NO	PTW	CPTW	ORIF NO	PTW	CPTW	ORIF NO	PBW	CPBW	ORIF NO	PBW	CPBW	CPTWA	CPBWA
1	1326.4	0.0123	31	1321.2	-0.0061	1	1328.4	0.0194	31	1322.4	-0.0020	0.0031	0.0087
2	1321.9	-0.0035	32	1323.8	0.0031	2	1324.8	0.0067	32	1322.3	-0.0021	-0.0002	0.0023
3	1328.0	0.0182	33	1327.5	0.0163	3	1330.4	0.0267	33	1329.3	0.0229	0.0172	0.0248
4	1327.0	0.0146	34	1327.6	0.0165	4	9999.9	9.9999	34	1325.2	0.0079	0.0156	0.0079
5	1327.2	0.0151	35	1326.2	0.0115	5	1329.4	0.0232	35	1325.5	0.0091	0.0133	0.0162
6	1325.3	0.0085	36	1325.0	0.0075	6	1328.0	0.0180	36	1326.3	0.0120	0.0080	0.0150
7	1324.9	0.0071	37	1324.1	0.0043	7	1328.8	0.0209	37	1325.2	0.0080	0.0057	0.0144
8	1324.5	0.0058	38	1324.1	0.0041	8	1325.5	0.0091	38	1324.5	0.0055	0.0050	0.0073
9	1324.9	0.0070	39	1323.8	0.0031	9	1326.4	0.0124	39	1323.4	0.0016	0.0050	0.0070
10	1323.9	0.0034	40	1321.4	-0.0053	10	9999.9	9.9999	40	1324.2	0.0044	-0.0010	0.0044
11	1322.7	-0.0007	41	1322.5	-0.0016	11	1326.1	0.0115	41	1324.6	0.0061	-0.0011	0.0088
12	1323.4	0.0017	42	1320.2	-0.0098	12	1323.4	0.0018	42	1325.0	0.0074	-0.0040	0.0046
13	1320.8	-0.0075	43	1321.8	-0.0041	13	1323.7	0.0029	43	1325.0	0.0074	-0.0058	0.0052
14	1320.5	-0.0087	44	1321.7	-0.0043	14	1323.8	0.0029	44	1325.3	0.0084	-0.0065	0.0057
15	1321.8	-0.0041	45	1321.8	-0.0039	15	1325.1	0.0077	45	9999.9	9.9999	-0.0040	0.0077
16	1322.1	-0.0031	46	1321.3	-0.0059	16	1324.7	0.0062	46	1322.4	-1.0488	-0.0045	0.0022
17	1321.7	-0.0042	47	1321.2	-0.0062	17	1321.6	-0.0049	47	1321.8	-0.0038	-0.0052	-0.0044
18	1321.8	-0.0041	48	1320.3	-0.0094	18	1324.4	0.0053	48	1321.1	-0.0063	-0.0068	-0.0005
19	1321.9	-0.0036	49	1319.4	-0.0124	19	1323.5	0.0019	49	1323.6	0.0025	-0.0080	0.0022
20	1321.8	-0.0040	50	1320.2	-0.0097	20	1321.6	-0.0049	50	1322.8	-0.0006	-0.0069	-0.0027
21	1318.8	-0.0149	51	1321.4	-0.0056	21	1323.0	0.0001	51	9999.9	9.9999	-0.0102	0.0001
22	1316.1	-0.0243	52	1319.4	-0.0124	22	1319.1	-0.0136	52	1324.5	0.0056	-0.0184	-0.0040
23	1318.7	-0.0149	53	1320.4	-0.0091	23	1321.6	-0.0047	53	1324.1	0.0042	-0.0120	-0.0002
24	1318.7	-0.0151	54	1320.6	-0.0081	24	1320.7	-0.0080	54	1323.1	0.0005	-0.0116	-0.0037
25	1318.9	-0.0144	55	1320.9	-0.0072	25	1321.7	-0.0041	55	1322.5	-0.0016	-0.0108	-0.0030
26	1316.8	-0.0219	56	1321.6	-0.0047	26	1323.0	0.0003	56	1324.0	0.0037	-0.0133	0.0020
27	1321.7	-0.0043	57	1325.3	0.0084	27	1324.5	0.0055	57	1325.0	0.0074	0.0020	0.0065
28	1320.9	-0.0072	58	1326.2	0.0116	28	1325.3	0.0085	58	1331.4	0.0303	0.0022	0.0194
29	1325.4	0.0088	59	1334.7	0.0421	29	1327.3	0.0156	59	1335.0	0.0429	0.0255	0.0292
30	1312.7	-0.0365	60	1324.2	0.0047	30	1313.4	-0.0339	60	1328.7	0.0207	-0.0159	-0.0066

Sample 3. Tunnel Near Wall Pressure Data

END

DTIC

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